HEA

HIGGINS ENVIRONMENTAL ASSOCIATES, INC.

Earth Science and Licensed Site Professional Services

19 Elizabeth Street
Amesbury, Massachusetts 01913

October 29, 2025

Delia R.J. Kaye, Director
Division of Natural Resources
Town of Concord
141 Keyes Road
Concord, Massachusetts 01742

RE: 2024-2025 Summary of Findings - Ecological Restoration of White Pond's Water Quality HEA Project No. 03136

Delia:

This letter report serves to summarize our activities, data and findings for ecological restoration services completed by our firm, Higgins Environmental Associates, Inc. (HEA) in Year 2024 through June 2025 at White Pond in Concord, Massachusetts in accordance with our Proposal No. 10220E dated June 27, 2024. Ecological restoration focused on permanently removing and reducing health risks associated with cyanobacteria also referred to as harmful algae blooms (HABs) or blue green algae (BGA) collectively "cyanoHABs" and excess nutrients and cyanotoxins from White Pond. Ecological restoration work was completed by passively harvesting and removing cyanobacteria from White Pond using a technology called the A-Pod (U.S. Patent No. 10,745.879). The Town of Concord purchased two Sentinel A-Pods in 2024 and training for operation and use of these was provided to the Town by HEA in June and July 2025.

To assist in HEA's evaluation and for the benefit of Concord, we have also included a summary of significant milestones achieved by HEA and passive harvesting with the A-Pods since 2021 at White Pond, initially for the National Science Foundation (NSF) field trial and then for Concord. A summary of field information from 2021 to early 2025 is provided in **Table 1 - Monthly Field Data Summaries**. Laboratory data for surface water sampling are summarized on **Table 2 - Surface Water Sampling Results**. Laboratory results for suspended solids, benthic algae, cyanoHABs, tree pollen and forest particulates, and sediment are summarized on **Table 3 - Recovered Solids and Sediment Sample Results**. Laboratory datasheets for samples collected in 2024 and 2025 are attached. HEA has provided detailed summary reports to the Town of Concord for work completed in 2022 and 2023. Monthly charts of water quality sonde data for 2024 are attached. Results in June 2025 were consistent with prior spring results since 2023.

The remainder of this letter report is broken down by section to aid the reader in understanding work completed and results achieved

2021-2025 SIGNIFICANT ECOLOGICAL, HEALTH AND RECREATIONAL MILESTONES ACHIEVED

As documented by information (field data and laboratory testing results) provided with this and prior summary reports, significant ecological restoration milestones have been achieved at White Pond as follows:

Control and Removal of CyanoHABs and Excess Nutrients

From the Fall of 2021 through 2022, an estimated 388.5 dry to moist pounds of cyanoHABs were permanently and sustainably removed from White Pond and biodegraded on land in a controlled manner. By laboratory analysis and weight of cyanoHABs removed, this equated to 0.97 pounds (0.44 kilograms) of phosphorus removed from the pond.

A fifty one percent (51 %) reduction in cyanoHAB biovolume (e.g., cyanoHAB biomass by water body volume) was achieved for White Pond from October 2021 to October 2022. As such, the total biomass of cyanoHABs in White Pond prior to removal using the A-Pods represented approximately 2 pounds of phosphorus. In 2021, cyanoHABs were the dominant phytoplankton specie to a depth of 50 feet in this 42 acre, 63 foot deep glacial kettle pond.

In 2023, a total of 349 pounds of primarily tree pollen and forest particulates were removed using the A-Pods with nominal cyanoHAB biomass content. Based on laboratory analysis, this represented a removal of 1.09 pounds of phosphorus.

In 2024, a total of 603 pounds of primarily tree pollen and forest particulates with nominal cyanoHABs biomass were removed which corresponded to a total of 0.70 pounds of phosphorus.

Although a larger amount of tree pollen and forest particulates (dry deposition) were removed in 2024 than prior years, the concentration of phosphorus by laboratory analysis in 2024 was approximately one third the concentration as in prior years, **Tables 1** and **3**.

In 2025, a total of 132 pounds of tree pollen with nominal cyanoHAB biomass was removed by the end of June using the A-Pods. Based on laboratory analysis, this represented 0.30 pounds of phosphorus. Based on observations and weight of pollen recovered with the A-Pods, 2025 was the lightest pollen year since 2021. Additional phosphorus will likely be removed as forest particulates for the remainder of the 2025 season.

In summary, based on laboratory analysis and measured amounts of phosphorus removed using the A-Pods as primarily pollen and forest particulates, annually recurring dry deposition (a non-point source of nutrients) would otherwise be sufficient in and of itself to support growth and potential health risks associated with cyanoHABs if not removed. Importantly, early season dry deposition also occurs in an otherwise clear-water, low nutrient time of the year for water bodies like White Pond and allows shallow water, ultraviolet light tolerant cyanoHAB species such as Microcystis and Dolichospermum to become a biovolume-dominant form by out competing other types of cyanoHABs and phytoplankton for these nutrients.

Control of Health Risks Posed by CyanoHABs

Board of Health restrictions or advisories for water contact were not required or issued in 2022 through present (July 2025 end of contract) when A-Pods were in-place and functioning to control and remove cyanoHABs, cyanotoxin health risks and excess nutrients notably from dry deposition (tree pollen and forest particulate). Health risks and water use restrictions had been posted annually for approximately five years at White Pond before use of the A-Pods to reduce risks and improve water quality.

Aquatic Habitat and Water Quality Improvements

Water clarity improved by approximately five feet in 2022 during cyanoHAB removal versus the prior 30-year median and water clarity improvements were sustained through 2023. In 2024, water clarity dropped to a seasonal median of 18.1 feet; attributed to particularly heavy tree pollen deposition. In 2025, water clarity was consistent with prior spring seasons and less tree pollen deposition was trapped and removed (132 pounds) than in 2024.

In 2023, the zooplankton population at White Pond had a higher biomass than observed by HEA at our reference station, Walden Pond. Similar types of zooplankton were observed at both ponds. By laboratory analysis of shallow (3 foot) and deep (30-50 foot) water samples, the phytoplankton community at White Pond in 2023 was diverse and not dominated by cyanoHABs.

A sustained increase in the depth of cold water suitable dissolved oxygen content occurred after removal of the dominant cyanoHAB biomass in 2021-2022. HEA attributes this to increased photic activity of the naturally-occurring, extensive benthic meadows at White Pond as a result of water clarity improvements by cyanoHAB removal in 2022. Cold water fisheries at White Pond had approximately five feet more favorable conditions than prior years.

Recreational Use and Water Body User Feedback

HEA continues to receive positive, unsolicited feedback from pond users (swimmers, fisherpeople) and residents around the pond. Feedback indicates the quality (improved water clarity; lack of health closures and cyanoHAB scums) of White Pond is the best people have seen in 30 years or more.

SIGNIFICANT FINDINGS

1. Passive Harvesting: A-Pod use allowed for quantifying the amount in pounds of nutrients and suspended solids (cyanoHABs and dry deposition of tree pollen and forest particulates) removed from White Pond.

   CyanoHAB removal: The 2021-2022 removed biomass of cyanoHABs weighed out at 388.5 pounds with a phosphorus content of 0.97 pounds and corresponded to a 51 percent reduction in cyanoHAB biomass measured with multiparameter sonde vertical profile surveys within the pond biovolume. Pounds of phosphorus removed combined with a biomass decrease of cyanoHABs of 51 percent indicates a total cyanoHAB biomass phosphorus content in White Pond, before removal of cyanoHABs, of approximately 2 pounds.

   Dry deposition removal: The non-point source nutrient loading content of dry deposition (tree pollen and forest particulates) removed in 2023 and 2024 with the A-Pods represented 70 percent or greater (0.70 to 1.09 pounds of phosphorus) of the 0.97 pounds of phosphorus in cyanoHABs removed from October 2021 to October 2022 (*i.e.*, equated to a 51 percent reduction of previously dominant cyanoHAB biomass).

2. Dry deposition, similar to USGS findings (Colman et al, 2001, USGS) for Walden Pond (*i.e.* 47 percent of annual non-point source loading by phosphorus calculated to be from dry deposition of tree pollen and forest particulates) represents a significant source of annually-recurring, non-point source nutrient loading to White Pond; more than enough to promote cyanoHAB dominance if not controlled and removed.

Dry deposition of tree pollen in particular also occurs early in the otherwise low-nutrient "clear water" surface water quality season (May to June). HEA's work at White Pond documented that early season pollen can be rapidly colonized as a nutrient source by cyanoHABs to increase their own biomass. CyanoHABs in shallow water with a high tolerance for ultraviolet (UV) light, such as Microcystis and Dolichospermum as noted at White Pond, can utilize this early-season nutrient loading source more readily than other, less UV-tolerant cyanoHABs.

The biomass, duration and annual frequency of nutrient-rich tree pollen production has been steadily increasing since 1990 due to climate change. Based on laboratory analysis, tree pollen and cyanoHABs at White Pond contained similar amounts of nutrients (carbon, iron, nitrogen, phosphorus and sulfur).

3. Recommendation: Annual removal of dry deposition using the A-Pods, particularly from May to June, should limit the development of health risks posed by cyanoHABs. It is also easier and safer to focus on removing this early season nutrient source as opposed to removing cyanoHABs that may otherwise develop later in the season.

4. After removal of the dominant cyanoHAB specie (Microcystis) in 2021-2022, a more diverse population of phytoplankton including cyanobacteria at depth, were documented in 2023. Water quality and aquatic habitat were improved by increases in both water clarity and dissolved oxygen content following removal of previously dominant cyanoHABs from the pond.

5. Based upon seasonal sediment gravity core sampling and laboratory analysis combined with reference to chronological dating of sediment layering by others, internal loading of nutrients from pond sediments, despite a relatively high nutrient content for phosphorus, is not occurring sufficiently to impact water quality or to be interpreted as a source of internal loading of concern. Part of this is due to lower ratios of sulfate/sulfide concentrations relative to iron in both sediment and surface waters compared to other water bodies where internal loading, caused by higher amounts of sulfur to iron are present.

   Importantly, the seasonal flux of phosphorus from sediment to surface water was also determined to be negative (a loss from surface water and binding with sediment over time). It may be that testing of upper sediment layers for available, amenable or "free" phosphorus would indicate that internal loading was occurring, but the seasonal flux (gaining or losing to surface waters) combined with lower ratios of sulfur to iron determines availability and uptake of phosphorus from sediment to surface water. Settling of nutrient-rich dry deposition, detritus and seston and non-seasonal assessment of internal loading (non-flux), may also lead to a bias that phosphorus is more available to surface water than is actually occurring over time. The in-place, soft sediment nutrient profile with sediment depth and age at White Pond also documented sedimentation (loss) of phosphorus over the past 1,500 hundred years at White Pond.

6. Despite a lack of inlets or outlets, White Pond has water currents that can be leveraged as part of passive harvesting using the A-Pods. Water currents and patterns were assessed using multiple hydrologic drogues deployed within the top 2 feet, at 4 feet and at 10 feet below the water surface with movements tracked over time. The direction and pattern of shallow water flow at White Pond was primarily clockwise (at 4 to 8 feet per minute depending upon depth). Only nominal flow was measured at 10 feet below the water surface.

   These water flow patterns and characteristics are not unique or uncommon as they relate to the interaction of a water body's internal conditions and forces (bathymetry, frictional forces, turbulence, shoreline morphology, water pressure and density) with external forces (wind direction, duration-strength and fetch, coriolis effect on large water bodies). The patented A-Pod technology uses these common natural water flow patterns to passively and sustainably trap and remove suspended solids like the cyanoHABs, early season tree pollen and ongoing forest particulate non-point nutrient sources.

7. Extensive beds of benthic, rooted algae, were, similar to Walden Pond, documented at White Pond. These "benthic meadows" would serve as important sinks for nutrients, as documented by laboratory analysis (**Table 3**) in addition to increasing biodiversity, habitat and improving water quality by their photosynthesis and increase in dissolved oxygen content of surface waters. Notably, benthic meadows were documented to a depth of approximately 45 feet, well below the secchi disc water clarity depth between 18 to 24 feet. While not visibly apparent to most people, it is important to safeguard and preserve the benthic meadows at White Pond.

REFERENCES

Any references to work or findings by others are fully documented in HEA's prior 2023 and 2024 annual summary reports provided to the Town of Concord for White Pond.

HEA has appreciated the opportunity to work with the Town of Concord on reducing health risks posed by cyanoHABs and sustainably improving the aquatic habitat and water quality of White Pond.

Sincerely,

Higgins Environmental Associates, Inc.

Jonathan B. Higgins, C.P.G., LSP
Principal Earth Scientist

Attachments:

Figure 1 - White Pond showing A-Pod location, bathymetry and mapped water currents
Table 1 **-** 2021 to 2025 Monthly Field Data
Table 2 **-** Surface Water Laboratory Results
Table 3 - Benthic Algae, Pollen, Trap Residue and Sediment Laboratory Results
Charts of 2024 Monthly Sonde Vertical Profile Data
- (BGA-Phycocyanin; Chlorophyll a; dissolved oxygen; oxidation-reduction potential; pH; temperature; and, water clarity.
Laboratory Datasheets for samples from 2024 and 2025 (WP-Pollen and A-Pod Residue)

D:/Projects/03136/2024-2025 Summary Report fnl.wpd
October 29, 2025 at 8:49 AM

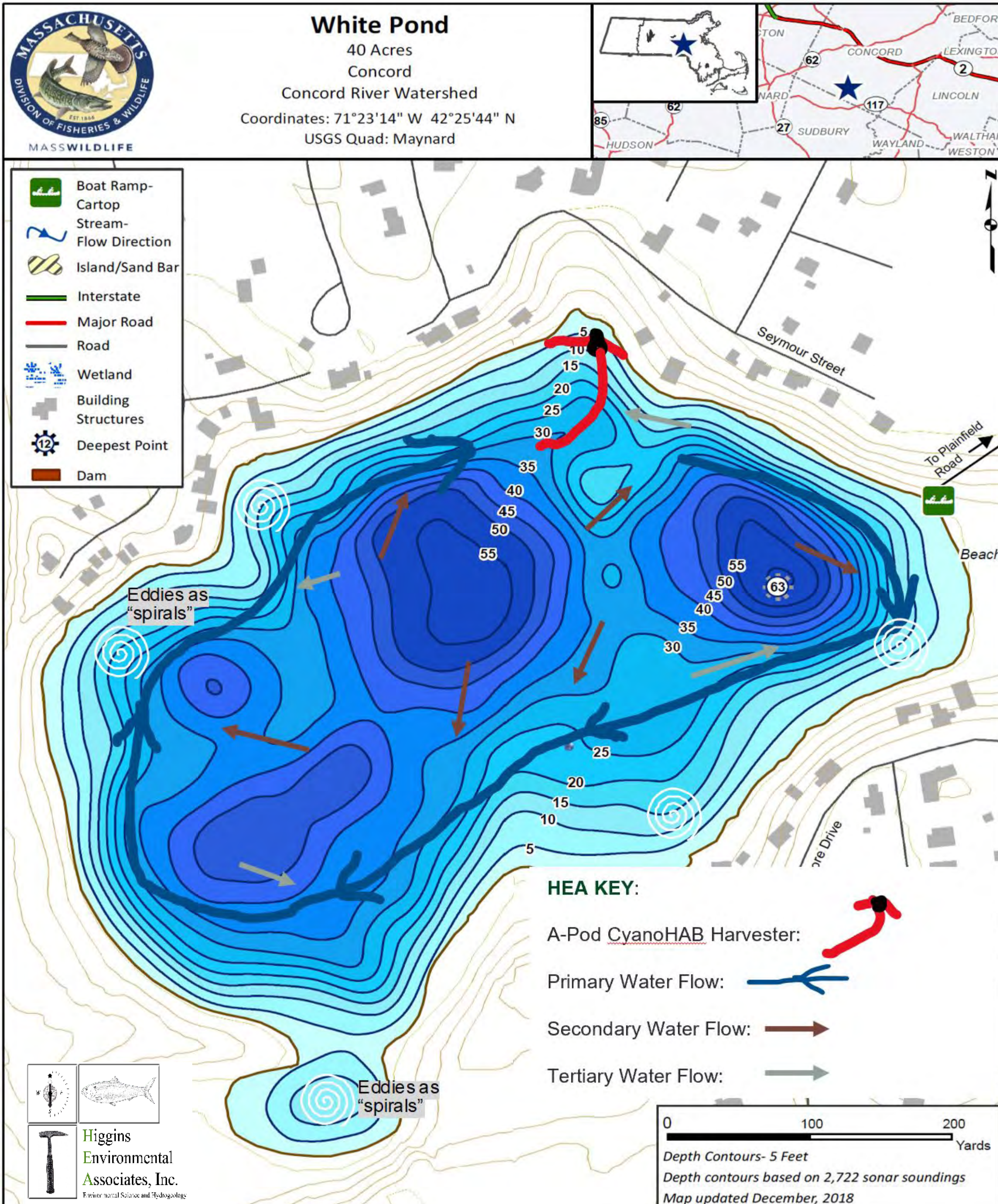

White Pond
40 Acres
Concord
Concord River Watershed
Coordinates: 71°23'14" W 42°25'44" N
USGS Quad: Maynard
MASSWILDLIFE
Boat Ramp-Cartop
Stream-Flow Direction
Island/Sand Bar
Interstate
Major Road
Road
Wetland
Building Structures
Deepest Point
Dam
CONCORD
BEDFORD
LEXINGTON
LINCOLN
SUDBURY
WAYLAND
WALTHAM
WESTON
HUDSON
Seymour Street
To Plainfield Road
Beach
Eddies as "spirals"
Eddies as "spirals"
63
HEA KEY:
A-Pod CyanoHAB Harvester:
Primary Water Flow:
Secondary Water Flow:
Tertiary Water Flow:
0
100
200
Yards
Depth Contours- 5 Feet
Depth contours based on 2,722 sonar soundings
Map updated December, 2018
Higgins Environmental Associates, Inc.

TABLE 1 - 2021-2025 MONTHLY FIELD DATA SUMMARIES FOR WHITE POND RESTORATION with A-Pods - EMPHASIS ON CYANOBACTERIA DATA

White Pond	Toxic Cyanobacteria Data	Maximum Field BGA-PC	Maximum Field Chl-a	C-Pod Field PC and Cyanotoxins		Field BGA-PC (Chla)	Open Water lab PC and Cyanotoxins		Walden - Water Clarity	White P. - Water Clarity	Depth to Sediment	CyanoHAB Scums
Monthly Records	Pounds Recovered (monthly)	A-Pod Trap	A-Pod Trap	Field Sonde PC	Lab Cyanotoxins	Open Water - @ 3 feet	Lab PC	Lab Cyanotoxins	(Secchi depth in Feet)	(Secchi depth in Feet)	Deepest Basin	In Pond?
Units of Measurement	U.S Pounds	RFUs	RFUs	ug/L	ug/L	RFUs	ug/L	ug/L	Feet	Feet		Visual
1987-2014 Data (by others)	None	Not Measured		Not Apgicable	Not Applicable	Not Measured	Not Measured	Not Measured		Median of 6 Meters(19.6ft)		Yes
2021 HEA White Pond Data												
July (7/16/21 East Hole)	No A-Pod	No A-Pod		No A-Pod	No A-Pod	2.32				Not measured		Yes
August (8/26/21 East Hole)	No A-Pod	No A-Pod		No A-Pod	No A-Pod	2.39				Not measured		Yes
October (10/7 Center Hole)	40	9.7 (Oct. 7)		221.03		2.14	4.27			Not measured		Yes
October (10/14 Trap)	60	131.6 (Oct. 14)		8689	35.9 Microcystin					Not measured		Yes
Year 2021	100 (estimate)	131.6		8689	35.9 Microcystin	2.28	4.27					Yes
2022 HEA White Pond Data												
May (5/5 East Basin)	None					1.69				31	61.9	No-Pollen
June (6/2 Center Basin)	75	13.46 (Jun. 14)		7.23	Not Detected	1.96	1.92	Not Detected		Not measured		Yes-spotty
July (7/13 East Basin)	110	24.86 (Jul. 5)				2.68				16.5 to 18.3	62.6	Yes-thin
August (8/16 East Basin)	35.5	18.57(Aug. 20)		17.2	0.08 Anatoxin	1.88	2.38	Not Detected		18.3 to 20.1	60.2	Yes-thin-spotty
September(9/8 East Basin)	8	10.32 (Sept.27)				1.55				19.6 to 22.5	58.7	No
October (10/12 East Basin)	40	53 (Oct. 16)		113.24	0.802 Microcystin	1.07	2.61	Not Detected		32.6	61.9	No
November (11/9 East Basin)	20	7.76 (Nov. 2)				1.20				20 to 27.6	60.4	No
December (12/5 East Basin	A-Pod removed 11/22/22	Not applicable		Not applicable	Not applicable	1.05				Not measured	59.2	No
Year 2022	288.5	53		113.24	0.802 Microcystin	1.64	2.61	Not Detected		Median of 24.2	60.4	No - Sept +
2023 HEA White Pond Data	A-Pod Setup May 11-12											
May (5/8-12 East Basin)	None (Tree Pollen increasing)	0	0.0244			0(0.0)			33.7	19.9	62.14	No
June (6/6 East Basin)	302 (pollen has Microcystis zoning)	0	6.558			0(0.359)			15.6	21.8	61.78	No
June 20th A-Pod	Pollen with cyanoHABs	0.385	6.811									
June 20th C-Pod	Pollen, Pond Water and cyanoHAB	54.755 [12]	6.31 [12]	54.755 RFUs[12]	7.9 Microcystin[12]							
June 24th C-Pod	Pollen, Pond Water and cyanoHAB	185.955 [12]	6.796 [12]	185.955 RFUs[12]	52.9 Microcystin[12]							
June 24th A-Pod	Pollen with cyanoHABs	10.26	6.885									
July (7/5 East Basin)	24 (pollen and detritus)	1.626	7.253			1.46(0.0)			25.1	28.3	63.16	No
August (8/2 East Basin)		1.48 (Aug 9th)	0.516 (Aug 9th)			3.40 (0.004518313)			20.4	24.2	62.1	No
September(9/6 East Basin)		2.63	1.008			2.87(0.0)	Sep 12th lab samples algae ID		26.6	26	63.28	No
October (10/3 East Hole)	23 A-Pod trap residue (no HABs)	0	0.6901			0.72(0.0)			25.5	25.1	62.57	No
November (11/6 East Basin)		0	0.653			0.0(0.000664315)				23	62.93	No
Year 2023	349 pollen and detritus in traps	10.26 (Apod) 186(Cpod)[12]	3.955	max. 185.955	max. 52.9	mean 0.89(0.052)	Concord BOH testing low	BOH low	Median 25.3	Median 24.2	Median 62.57	No
2024 HEA White Pond Data	A-Pod Setup May 29											
May 29th East Basin	Tree Pollen being trapped	0	0.00846			0(0.012)					61.7	No
June 5-11th A-Pod/Basin	467 Tree Pollen	0	0.0068			0(0.359)	Sampled trap pollen			14		No
June 15th A-Pod/Basin	30 Pollen in traps	0	NT			0(NT)				15.5		No
June 18th A-Pod/Basin	less pollen in traps	NT	0.0049							18		No
June 26th East Basin	22 pollen and forest part.	NT	NT			1.68(0.002)				18.7	55.2	No
July 2nd A-Pod/perimeter	Little pollen and forest part.	1.62	1.76				perimeter survey					No
July 8th A-Pod	15 forest particulates	1.21	0.035									No
July 16 A-Pod	30 forest particulates	2.01	1.33			2.02(0.000)				17.1		No
July 24 A-Pod	15 forest particulates	1.83	1.43									No
July 31 A-Pod	5 forest particulates	1.23	1.42									No
August 7 A-Pod/Basin		0.99	1.73			1.73(0.000)				19		No
August 22 A-Pod/Basin	non HAB Scum in traps	0.81	2.55			1.26(0.000)				15.1	60.3	No
September 10 Apod/Basin	14 forest part and non HAB scum	0.65	4.39			0.48(0.000)				18.4	63	No
Oct 8 Apod/Basin		0.23	2.7			1.12(0.47)				20.4		No
Nov 7 Apod/Basin		0.42	0.011			0.93(0.26)	Sampled trap residuals			19.9	65	No
Dec 9 Apod		0.73	0.027									No
Dec 17 Basin	5 trap residue removed					0.92(0.000)				20.7	62	No
Year 2024	467 pollen + 136 mixed other	2.01	4.39			2.02(0.47)				Median 18.4	Median 62	No
2025 HEA White Pond Data	A-Pod Setup/training June 2											
June 5-8 A-Pod	90 Tree Pollen	NT	NT			NT						No
June 12 Apod/Basin	42 Pollen and HAB Scum	95.21	4.69			1.75(0.0024)	Dolichospermum L.			18	54	Yes only in traps
June 26 Apod/Basin	slight forest particulates	1.08	0.016			1.99(0.010)	perimeter survey				61.3	No
July 9 - 18 training	slight forest particulates	NT	NT			NT				21.8		No
Contract over June 30th	132 pounds subtotal for 2025											

Note:
1. Year 2022 monthly records represent by month: dry-moist pounds of cyanobacteria removed with the A-Pods; maximum BGA-PC in the A-Pod Trap; lab results when available; water clarity by secchi disc; PC and Cyanotoxin results on dates noted in "()" in column or by Monthly Records Column date.
2. 2021 data is from Higgins Environmental Associates National Science Foundation (NSF) funded field trail with dates noted in "()". Sonde fitted with 30 foot cable for measurements (correction value applied of +1.54893 for 100 foot cable comparison). In 2022, sonde fitted with 100 foot cable.
3. Monthly records maintained by Higgins Environmental Associates field scientist unless noted otherwise; 1987-2014 data from W.Walker 2015 Summary of White Pond Data (http://www.wwwalker.net/whitepond/)
4. Field BGA-PC = field measurements using a multiparameter sonde (Insitu AquaTroll 500) fitted with a blue-green algae (BGA) - phycocyanin (PC) probe with measurements in Relative Flouresence Units (RFUs)
Most data is from vertical sonde surveys taken monthly and during lab sampling. Sonde snapshots were collected more frequently from A-Pod Trap areas. Other vertical sonde surveys were collected throughout the pond to assess water body quality variance.
5. Lab PC data results provided by the University of New Hampshire. Field BGA-PC at same time/day/location noted in "()". Lab PC is reported in micrograms per liter (ug/L).
6. Average Field Open Water BGA-PC represents the average of vertical sonde survey results from the corresponding date and location noted in the Monthly Records column. Based on multiple vertical surveys, this data also represents the biovolume of PC for the pond as a whole on that day.
7. BGA = blue green algae; PC = phycocyanin; PC is a measure of cyanobacteria biomass at each sample and when correlated to water body volume, serves to represent pond PC biovolume.
8. Water clarity as reported was measured with a secchi disc without the use of a view scope. 1987-2017 secchi disc data utilized a view scope. As such, 2022 results are considered conservative.
A median secchi disc depth (i.e., water clarity) reading from 1987 to 2017 was calculated at approximately 6 meters (19.7 feet). This has been referred to as the historic baseline secchi disc depth reference.
Most of the historic mean secchi readings were obtained between June to August of each year when the sunlight angle is higher than earlier or later months of the year for this latitude. Our median values in both 2022 and 2023 were each 24.2 feet (approx. 8 meters).
9. May 11 to 12, 2023, A-Pods set up in Thoreau's cove. May 20, 2022 main A-Pod set up in Thoreau's cove. November 22, 2022 main A-Pod removed from Thoreau's Cove. In 2021, main A-Pod set up in Thoreau's cove on August 30th and removed on October 20th, 2021.
10. A total of 288.5 (dry-moist) pounds of cynobacteria were removed in Year 2022 using the A-Pod and were composted on land in a controlled manner. Approximately 100 (moist to wet) pounds were removed in 2021 and composted as part of our NSF-funded trial.
11. On September 28, 2022 water velocity in White Pond calculated using depth specific drogues to be: 8 feet/minute at 2 feet deep; 6 to 7.5 feet/minute at 4 feet deep; negligible at 10 feet deep. Drogue flow patterns in 2022 indicate clockwise flow pattern with eddies near some shore/structure areas.
12. On June 20 and 24th, field PC readings within the C-Pod after addition of trap contents ranged from 54.755 to 185.955 RFUs; Chl--a ranged from 6.31 to 6.796 RFUs; and cyanotoxins (MC) ranged from 7.9 to 52.9 ug/l, respectively. C-Pod contents removed on June 24, 2023 after sampling.
13. June 2025 through July 18th focused on A-Pod training to Town. HAB scum noted in traps only on June 12th, likely colonizing off of tree pollen in trap. Trap contents removed each day and composted. HAB scum and pollen June 12th placed in rotary compost bin for biodegradation.

Table 2 - Surface Water Sample Results - White Pond, Concord, MA

Horizontal Water Quality Profiles

Sample ID:	WP-Trap		WP-Trap		WP-Trap		WP-In		WP-In		WP-In		WP-Out		WP-Out		WP-Out		
Lab Sample Number:	2F03025-01		2H17031-01		2J13028-01		2F03025-02		2H17031-02		2J13028-02		2F03025-03		2H17031-03		2J13028-03		
Date Sampled:	6/2/2022		8/16/2022		10/12/2022		6/2/2022		8/16/2022		10/12/2022		6/2/2022		8/16/2022		10/12/2022		
Parameter	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Units
General Chemistry																			
Nitrate and Nitrite as N	ND	0.03	ND	0.03	ND	0.03	**0.03**	0.03	**0.08**	0.03	**0.04**	0.03	**0.03**	0.03	**0.04**	0.03	ND	0.03	mg/L
Total Nitrogen	**0.6**	0.1	**0.8**	0.1	**1.1**	0.1	**0.23**	0.1	**0.38**	0.1	**0.54**	0.1	**0.13**	0.1	**0.34**	0.1	**0.5**	0.1	mg/L
Kjeldahl Nitrogen	**0.6**	0.1	**0.8**	0.1	**1.1**	0.1	**0.2**	0.1	**0.3**	0.1	**0.5**	0.1	**0.1**	0.1	**0.3**	0.1	**0.5**	0.1	mg/L
Total Phosphorous	**0.05**	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	mg/L
Total Organic Carbon	**3.7**	0.5	**3.1**	0.2	**4**	0.2	**2.7**	0.5	**2.7**	0.2	**2.4**	0.2	**2.7**	0.5	**2.7**	0.2	**2.5**	0.2	mg/L
Total Metals																			
Iron	**0.17**	0.05	**0.49**	0.05	**0.4**	0.05	ND	0.05	ND	0.05	**0.08**	0.05	ND	0.05	ND	0.05	**0.05**	0.05	mg/L
Sulfur	**1.5**	0.5	**1.3**	0.5	**1.2**	0.5	**1.4**	0.5	**1.3**	0.5	**1.2**	0.5	**1.3**	0.5	**1.4**	0.5	**1.2**	0.5	mg/L
Field Measured Phycocyanin at Sampling																			
Phycocyanin	**1.87**		**1.95**		**4.02**		**0.251**		**1.91**		**0.87**		**2.09**		**1.74**		**1.1**		RFUs
Phycocyanin and Cyanotoxins by Laboratory Analysis																			
Phycocyanin	**7.23**		**17.2**		**113.24**		**4.46**		**2.51**		**1.69**		**1.92**		**2.38**		**2.61**		ug/L
Cyanotoxin	**ND**		see below		see below		**ND**		see below		**ND**		**ND**		**ND**		**ND**		ug/L
Microcystin					**0.802**														ug/L
Anatoxin			**0.08**						**0.11**										ug/L

Vertical Water Quality Profiles

Sample ID:	WP-10		WP-30		WP-50		WP-55		
Lab Sample Number:	3I28075-01		3I28075-02		3I28075-03		3I28075-04		
Date Sampled:	9/27/2023		9/27/2023		9/27/2023		9/27/2023		
Parameter	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Units
General Chemistry									
Nitrate and Nitrite as N	ND	0.25	ND	0.25	ND	0.25	ND	0.25	mg/L
Total Nitrogen	ND	0.1	**0.7**	0.1	**0.6**	0.1	**2.7**	0.1	mg/L
Kjeldahl Nitrogen	ND	0.1	**0.7**	0.1	**0.6**	0.1	**2.7**	0.1	mg/L
Total Phosphorous	**0.006**	0.005	**0.005**	0.005	**0.015**	0.005	**0.048**	0.005	mg/L
Total Organic Carbon	**2.4**	0.2	**2.6**	0.2	**2.4**	0.2	**4.3**	0.2	mg/L
Total Metals									
Iron	ND	0.05	**0.09**	0.05	**0.22**	0.05	**5.4**	0.05	mg/L
Sulfur	**1.3**	0.5	**1.3**	0.5	**1.4**	0.5	**1**	0.5	mg/L
Additional Historical Testing by Others									
Chlorophyll-a									ug/L
Secchi Depth (during sampling 9/27/24)	24.5		24.5		24.5		24.5		feet
									ug/L
Field Measured Phycocyanin and Chlorophyll-a in RFUs									
Phycocyanin	0.56		0.53		3.21		2.03		RFUs
Chlorophyll-a	0.004		0.004		2.33		1.06		RFUs
Phycocyanin and Cyanotoxins by Laboratory Analysis									
Phycocyanin (WLW PC to low on field RFUs)									ug/L
Cyanotoxin (refer to Concord BOH files									ug/L
Microcystin									ug/L
Anatoxin									ug/L

Notes for Table 2:

1. All samples collected as discrete (grab) samples.
2. All results reported as total on a wet weight basis. mg/L = milligrams per liter; RFUs = relative fluoresence units; ug/L = micrograms per liter.
3. ND = not detected at or above reporting limit noted.
4. Detected results are highlighted in yellow with bold typeface. Cyanotoxin non-detect data also highlighted in yellow and bold typeface given its importance.
5. Preservatives - laboratory pre-preserved bottles per Standard Methods and Analytes (HNO3 for Fe, S; H2SO4 for N and C; none for P and N; all cooled to less than 4 degrees Celcius from collection to analysis).

Table 3 - Benthic Macroalgae (Nitella), Recovered CyanoHABs, A-Pod Residue and Sediment Sample Results - White Pond

	Benthic Algae		2021 to 2022 Cyanobacteria (HAB) Samples					
Sample ID:	BPLNT-1		APOD HAB		HAB1-22		HAB-2-22	
Lab Sample Number:	1I15020-03		1J15038-04		2H17029-06		2J13027-01	
Date Sampled:	9/14/2021		10/14/2021		7/5/2022		10/7/22	
Parameter	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit
General Chemistry								
Nitrate and Nitrite as N	Not Tested		Not Tested		**492**	23	ND	7
Total Nitrogen	**3050**	10	**5860**	0.1	**12400**	10	**18200**	10
Kjeldahl Nitrogen	Not Tested		Not Tested		**11900**	440	**18200**	1490
Total Phosphorous	**1570**	1.39	**3630**	2.39	**2200**	1.62	**2040**	2.53
Total Organic Carbon	**46**	0	**40**	0	**36**	0	**40**	0
Total Metals								
Iron	**9550**	14	**12000**	24.1	**9360**	16.3	**7320**	25.6
Sulfur	**3970**	140	**3680**	241	**3230**	163	**2690**	256

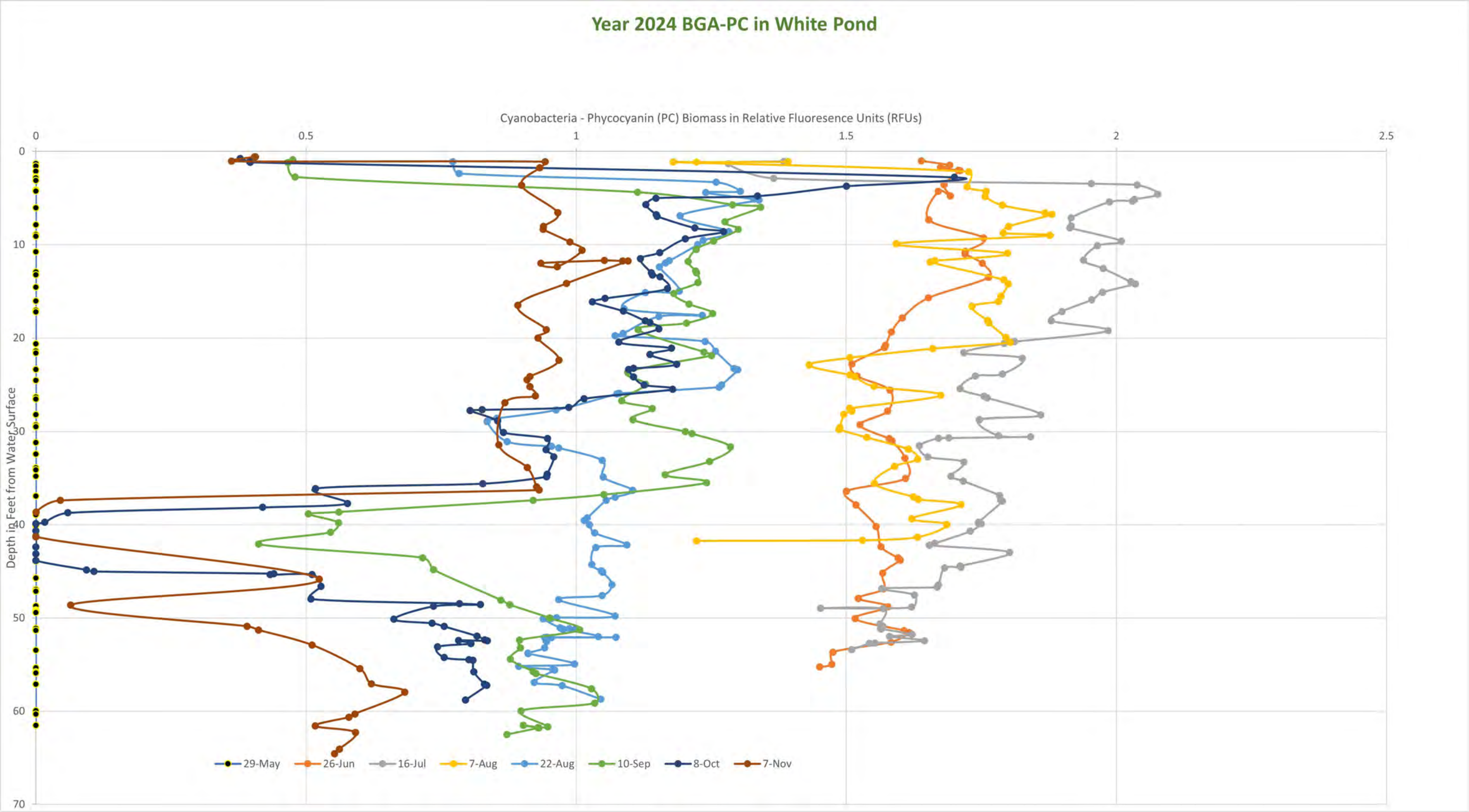
	2023		2023		2023		2024		2024		2025		
Sample ID:	WP-Oak Pollen		WP-Pine Pollen		A-Pod Residue		WP-Pollen		A-Pod Residue		WP-Pollen		
Lab Sample Number:	3E18042-04		3F06024-01		3K09056-01		4F24019-01		4K11017-01		5G30011-01		
Date Sampled:	5/16/2023		6/1/2023		10/24/2023		6/5/2024		11/7/2024		6/5/2025		
Parameter	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Units
General Chemistry													
Nitrate and Nitrite as N	Not Tested		Not Tested		Not Tested		Not Tested		Not Tested		**ND**	28.7	mg/kg
Total Nitrogen	**11500**	10	**10500**	10	**1240**	10	**10000**	10	**213**	10	**1520**	10	mg/kg
Kjeldahl Nitrogen	Not Tested		Not Tested		Not Tested		Not Tested		Not Tested		**1340**	57	mg/kg
Total Phosphorous	**2710**	4.33	**2820**	3.71	**3810**	1.23	**1430**	3.03	**882**	1.58	**2290**	2.34	mg/kg
Total Organic Carbon	**52**	0	**52**	0	**36**	0	**50**	0	**44**	0	**46**	0	Percent (%)
Total Metals													
Iron	**2130**	58.8	**4330**	37.4	**2170**	12.4	**3050**	30.6	**5550**	15.9	**6000**	23.6	mg/kg
Sulfur	**2350**	588	**1930**	374	**2070**	124	**1650**	306	**2200**	159	**2420**	236	mg/kg

	2021 to 2022 Sediment Samples												
Sample ID:	SED1 WHTS		SED2 WP		SED 3 -WP5	WP-ED-6"		WP-CD-6"		WP-WD-6"		WP-EH-62'	
Lab Sample Number:	1G21034-01		1H31016-01		1K10047-01	2H17028-03		2H17028-04		2H17028-05		2K10018-03	
Date Sampled:	7/16/2021		8/26/2021		11/9/21	8/10/2022		8/10/2022		8/10/2022		11/7/2022	
Parameter	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Results East Hole	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit
General Chemistry	East Hole top 6"		Thoreaus Cove 6"		EH Vert Profile to 24" Top 2"/4-8"/16-	East Hole to 6"		Center Hole to 6"		West Hole to 6"		East Hole Top 2"	
Nitrate and Nitrite as N	Not Tested		Not Tested		Not Tested	**153**	7	**224**	11	**504**	24	**204**	10
Total Nitrogen	**7620**	0.1	**229**	10	**1130/1680/1650**	**10500**	10	**14500**	10	**22400**	10	**8840**	10
Kjeldahl Nitrogen	Not Tested		Not Tested		Not Tested	**10300**	154	**14300**	236	**21900**	443	**8640**	985
Total Phosphorous	**580**	2.39	**899**	1.47	**2250/2740/2460**	**2100**	0.55	**2410**	0.91	**2390**	1.22	**1990**	1.6
Total Organic Carbon	**3**	0	**10**	0	**16/30/29**	**16**	0	**23**	0	**26**	0	**16**	0
Total Metals													
Iron	**8600**	24.1	**10500**	14.8	**27300/10100/9280**	**18100**	5.5	**10500**	9.1	**11000**	12.3	**25700**	16.2
Sulfur	**2370**	241	**3030**	148	**9870/4790/4470**	**6000**	55.4	**5280**	91.4	**6180**	123	**11400**	162

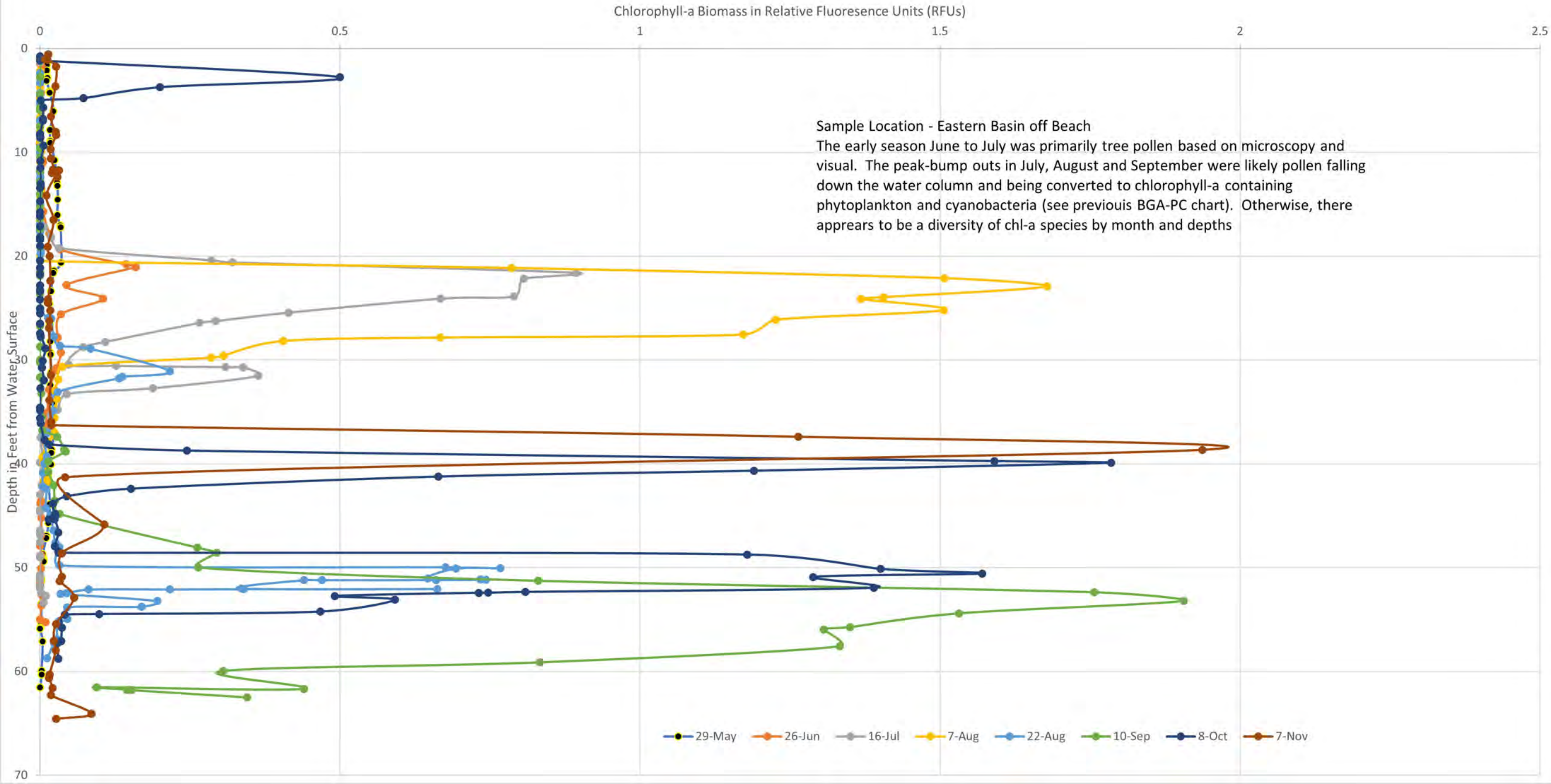
	2023		2023		2023		2023		2023		2023		
Sample ID:	EH-T2"-Core		EH-6"-CORE		EH-62'-T2"		WP-EH-6"-CORE		EH-T2"-Core		EH-62'-T2"		
Lab Sample Number:	3E18042-01		3E18042-02		3E18042-03		3I28075-05		3K09056-02		3K09056-03		
Date Sampled:	5/16/2023		5/16/2023		5/16/2023		9/27/2023		11/6/2023		11/6/2023		
Parameter	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Units
General Chemistry	East Hole with Core		East Hole with Core		East Hole Disc. Samp.		East Hole with Core		East Hole with Core		East Hole Disc. Samp.		
Nitrate and Nitrite as N	Not Tested		Not Tested		Not Tested		**3.24**	2.25	Not Tested		Not Tested		mg/kg
Total Nitrogen	**1360**	10	**5510**	10	**17700**	10	**798**	10	**16000**	10	**24200**	10	mg/kg
Kjeldahl Nitrogen	Not Tested		Not Tested		Not Tested		**795**	110	Not Tested		Not Tested		mg/kg
Total Phosphorous	**2250**	2.57	**2520**	3.87	**3190**	6.4	**2040**	6.4	**3440**	3.78	**2140**	1.6	mg/kg
Total Organic Carbon	**49**	0	**50**	0	**51**	0	**21**	0	**22**	0	**25**	0	Percent (%)
Total Metals													
Iron	**28000**	26	**10100**	39	**36000**	64.6	**7450**	64.6	**30000**	38.2	**19600**	16.2	mg/kg
Sulfur	**11800**	260	**4720**	390	**13200**	646	**20200**	646	**10800**	382	**7110**	162	mg/kg

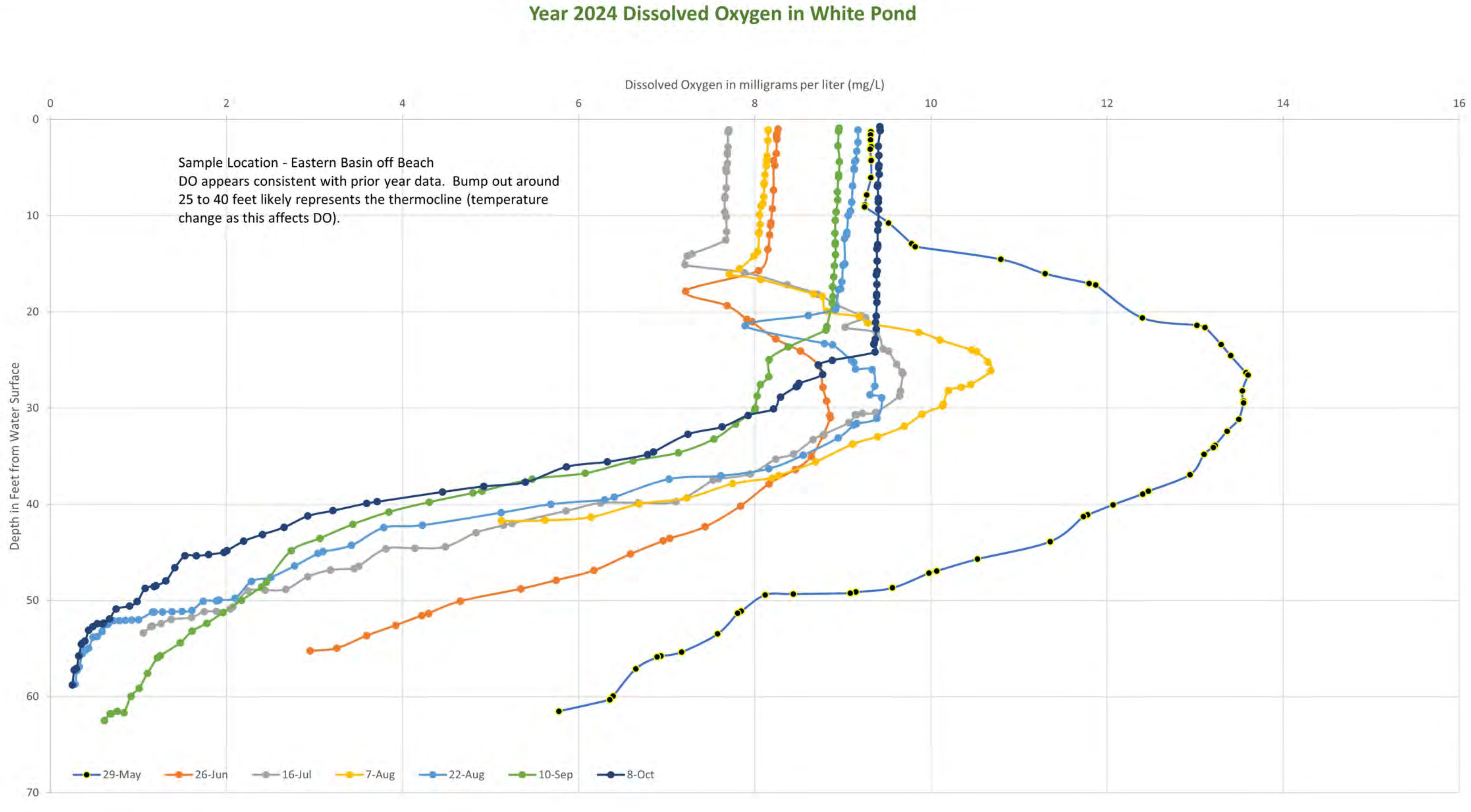
Notes for Table 3:

1. HAB = harmful algae bloom; HAB1-22 sample is a composite of 35 pounds of partially-dried HAB removed from main A-Pod Trap "A" on June 29, 2022; HAB2-22 is a composite of 40 pounds of partially-dried HABs removed from A-Pod "A" in Oct 2022.
2. All HAB samples collected as composite samples on date sampled. Sediment samples collected as discrete samples over specified interval (either top 2 inches; top 6 inches; or at 6 inch intervals at SED3-WP5 from a 0 to 24 inch core sample).
3. All results reported as total on a dry weight basis.
4. ND = not detected at or above reporting limit noted.
5. Detected results are highlighted in yellow with bold typeface.
6. Preservatives - samples frozen after collection until laboratory analysis.
7. APOD HAB sample from 10/14/21 was part of our NSF funded work; and serves as a Year 2021 year end "background sample" for Concord's Year 2022 work and results for HAB solids.
8. Most sediment samples were collected and analyzed as part of HEA's National Science Foundation (NSF) work; presented results are summarized for informational purposes only.
9. Sample SED3-WP5 was collected using a gravity corer with intact recovery of 24 inches (60 centimeters) of soft sediment. Discrete sediment samples were collected and results reported from the core as follows: top 2 inches/ 4 to 8 inches / 16 to 24 inches.
10. Sample WP-EH-62 was collected in the east hole (deep basin off beach) using a discrete water sampler which is helpful for collecting the very loose, almost smoke-like top 2 inches of sediment. This sample was primarily green-colored detritus with active microbial populations.
11. BPLNT1 = benthic macroalgae (Nitella) sample collected as part of HEA's NSF work from a grab sample approximately 30 feet deep south of Thoreau's cove.
12. 2023 A-Pod residue sample is a sample of residue collected within the A-Pod trap over the July to October 2023 season (a brown organic-rich material). May-July trap contents were previously removed as tree pollen solids with some cyanoHAB colonization.
13. 2023 EH-T6" AND T2"-CORE samples collected as an insitu gravity core sample with top six inches and top two inches respectively. Core sediments were visually undisturbed and overlying core water was not turbid. Sediment layering noted and top included black mottling (interpreted as sulfides).
14. 2023 EH-62'-T2" sample collected using a discrete water sampler of the very fine, easily suspended sediments (top 2 inches and less) at 62 feet (east deep hole); same location as EH-T2"-CORE. This sample would include more recent detritus/seston by volume than the CORE sample.
15. 2024 Samples collected as composite samples from trap contents on day of sampling.
16. 2025 WP Pollen sample collected as composite sample from trap contents removed on June 5, 2025; sample kept frozen until lab analysis.
17. Unless noted otherwise, samples labled "pollen" were primarily white pine pollen based on microscopic confirmation.
18. Year 2025 was a lighter pollen year than 2024 and 2023. Year 2024 had the most pine pollen collected based on trap content weight based on scale measurements and microscopic confirmation.


Year 2024 BGA-PC in White Pond
Cyanobacteria - Phycocyanin (PC) Biomass in Relative Fluoresence Units (RFUs)
0
0.5
1
1.5
2
2.5
Depth in Feet from Water Surface
0
10
20
30
40
50
60
70
29-May
26-Jun
16-Jul
7-Aug
22-Aug
10-Sep
8-Oct
7-Nov

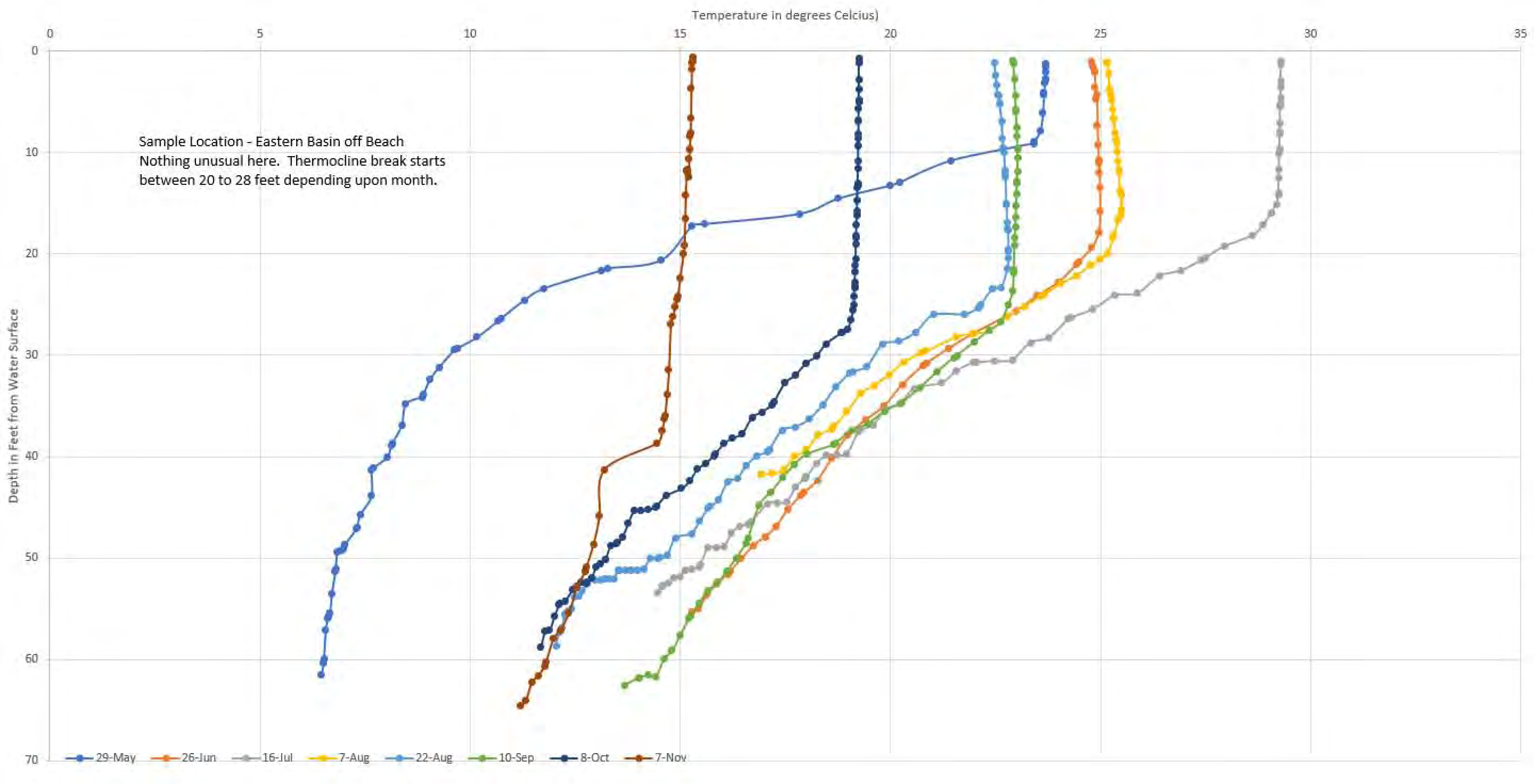
Year 2024 Chlorophyll-a in White Pond

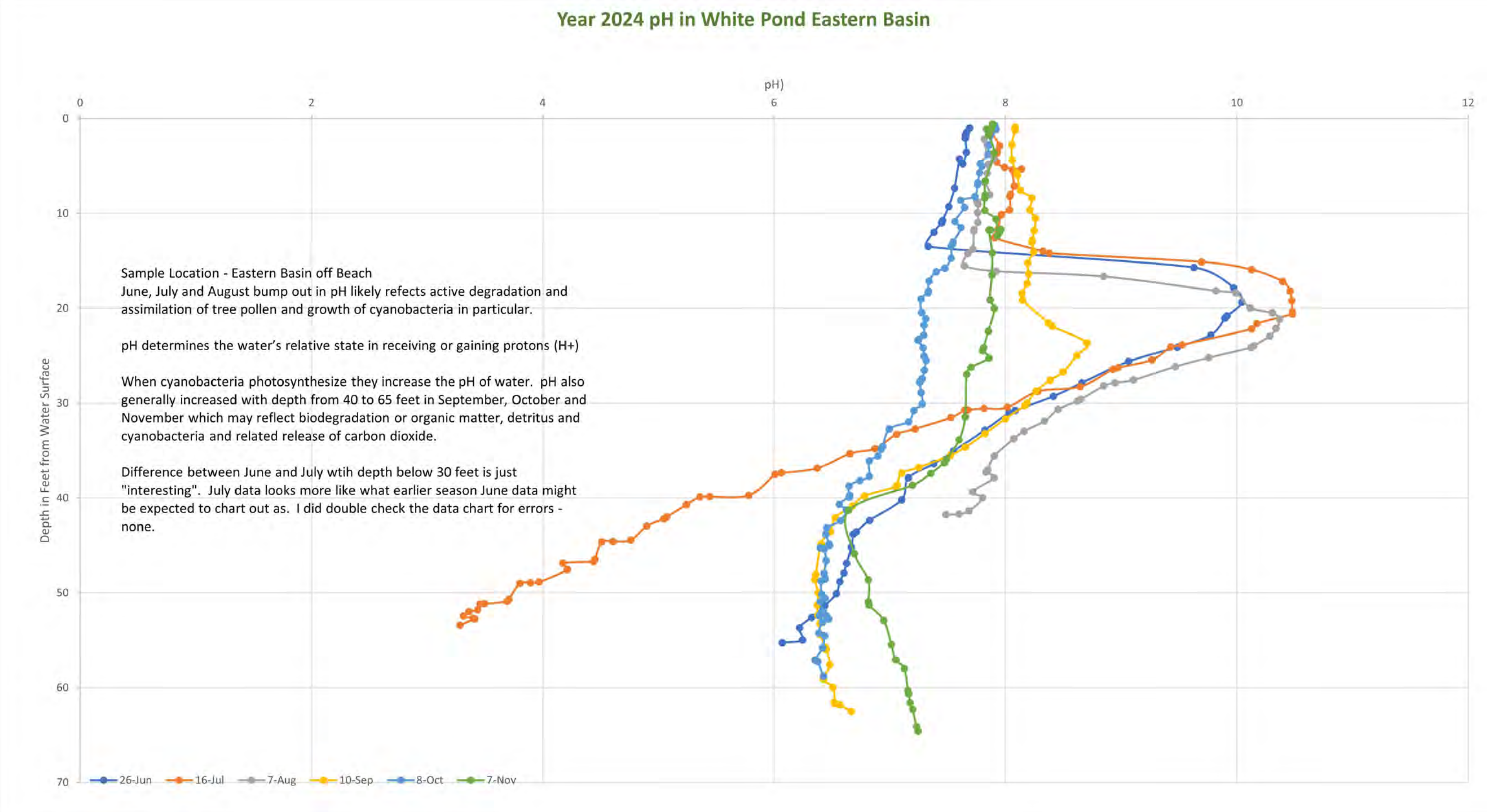




Year 2024 Dissolved Oxygen in White Pond
Dissolved Oxygen in milligrams per liter (mg/L)
0
2
4
6
8
10
12
14
16
0
10
20
30
40
50
60
70
Depth in Feet from Water Surface
Sample Location - Eastern Basin off Beach
DO appears consistent with prior year data. Bump out around
25 to 40 feet likely represents the thermocline (temperature
change as this affects DO).
29-May
26-Jun
16-Jul
7-Aug
22-Aug
10-Sep
8-Oct

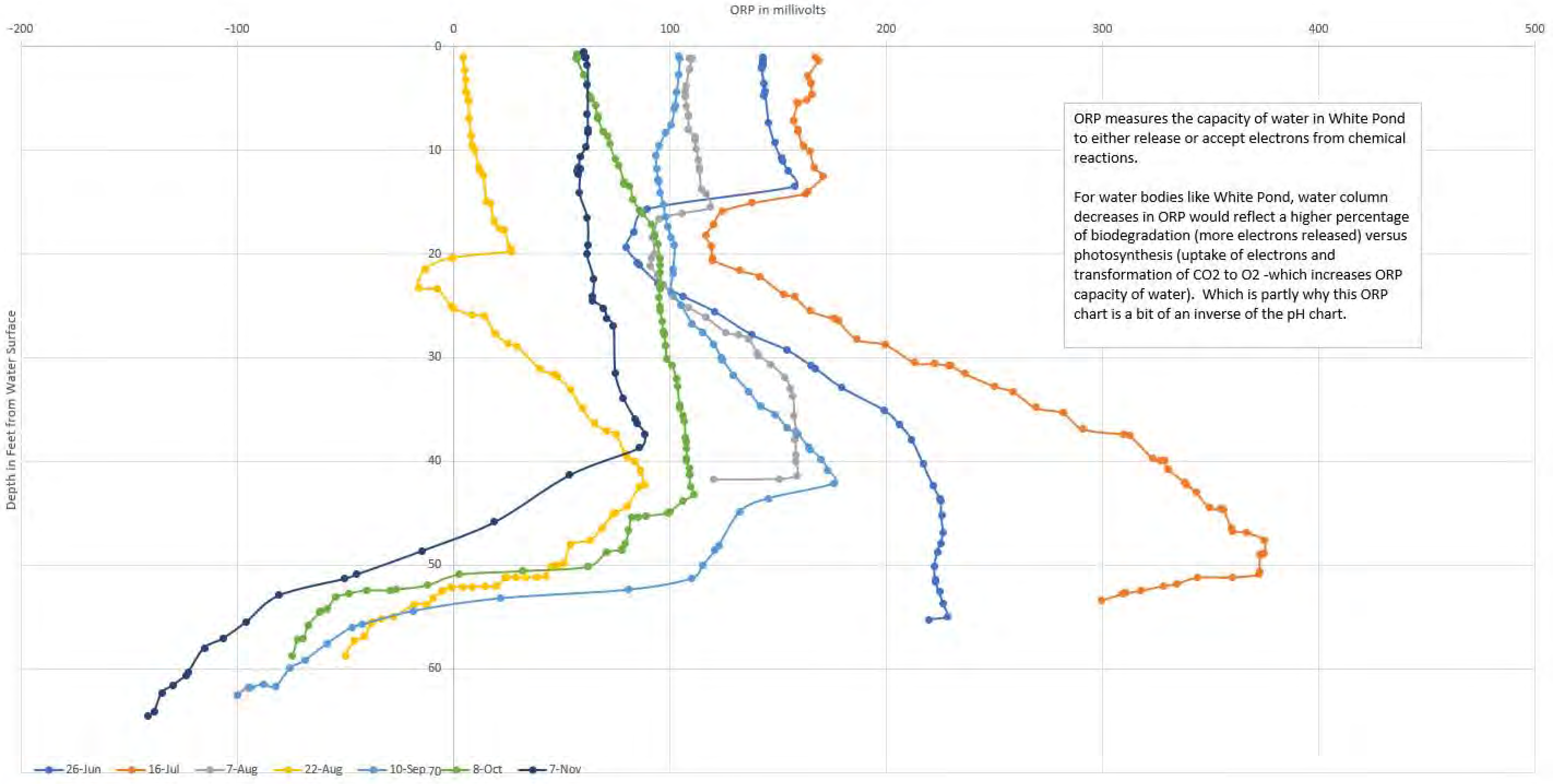
Year 2024 Temperature in White Pond

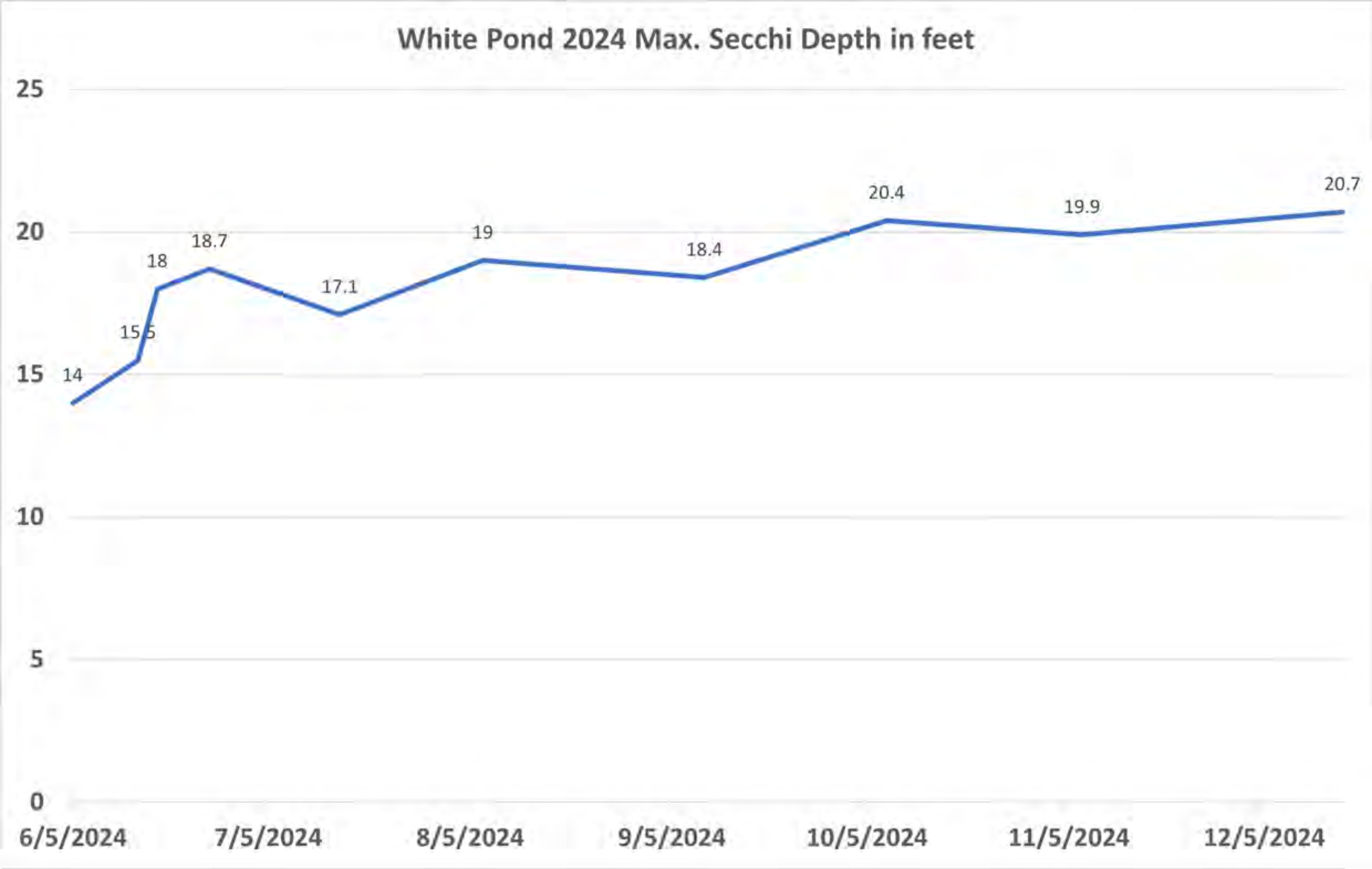




Year 2024 pH in White Pond Eastern Basin
pH)
0
2
4
6
8
10
12
Depth in Feet from Water Surface
0
10
20
30
40
50
60
70
Sample Location - Eastern Basin off Beach
June, July and August bump out in pH likely refects active degradation and assimilation of tree pollen and growth of cyanobacteria in particular.
pH determines the water's relative state in receiving or gaining protons (H+)
When cyanobacteria photosynthesize they increase the pH of water. pH also generally increased with depth from 40 to 65 feet in September, October and November which may reflect biodegradation or organic matter, detritus and cyanobacteria and related release of carbon dioxide.
Difference between June and July wtih depth below 30 feet is just "interesting". July data looks more like what earlier season June data might be expected to chart out as. I did double check the data chart for errors - none.
26-Jun
16-Jul
7-Aug
10-Sep
8-Oct
7-Nov

Year 2024 Oxidation-Reduction Potential (ORP) in White Pond




White Pond 2024 Max. Secchi Depth in feet
25
20
15
10
5
0
14
15.5
18
18.7
17.1
19
18.4
20.4
19.9
20.7
6/5/2024
7/5/2024
8/5/2024
9/5/2024
10/5/2024
11/5/2024
12/5/2024